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WATER ANALYSIS INTERPRETATION

To make a judgment on the suitability of a water supply for any class of livestock, it is necessary to consider each case individually, giving attention to the class and physical condition of the animals, the environment, the feed and the water. The reasoning for this approach is more fully explained in the following excerpt from the National Academy of Sciences publication entitled "Nutrients and Toxic Substances in Water for Livestock and Poultry" (p. 51-52).

> Whether from natural or human sources, water occasionally contains elements or substances in toxic amounts. Unfortunately, only limited information is available on experimentally determined toxic levels of various substances in water for livestock and poultry. Good judgment is necessary when applying information reported in the literature to practical situations. So many conditions are involved in determining whether or not certain levels of a toxicant will cause harm that no single concentration can be accepted as dangerous in all situations.
>
> Following are some examples of the problems involved in assigning toxic levels to waterborne substances. Toxic substances may be present in water in solution or as suspended solids. The nutritional availability of toxic elements or substances in these phases may differ considerably among animals. Different chemical forms of the elements frequently result in different toxicities to the animals consuming them. Short-term intake of a toxic substance may have no observable effects, while long term consumption may result in serious harm. Different species of animals may react differently to a toxic substance, and young, healthy animals may not respond in the same way as mature or unthrifty animals. The rate of consumption may also be involved. Antagonistic or synergistic substances present in either water or feed, or additional toxic material in the feed, may at times be significant factors. Finally, intake of toxic substances that cause no measurable effect on growth, production, or reproduction may cause subcellular damage that expresses itself as increased susceptibility to disease or to parasitic invasion.

It should be pointed out that water sources, especially those from surface or shallow wells, can be subject to sudden changes in composition from natural or human causes.

Copies of this and related publications may be obtained from the Print Media Branch, Alberta Agriculture, 7000 - 113 Street, Edmonton T6H 5T6 or Alberta Agriculture's District Offices.

WATER QUALITY INTERPRETATION CHART FOR LIVESTOCK

Meaningful use of this chart must include a consideration of the salt and mineral content of feed used in conjunction with the water under study. Most of the figures in this chart were obtained from studies where the feed contained levels of salt and minerals that were not in excess of the requirements of the livestock species studied.

Item analysed	Water content (ppm)	Usefulness for poultry	Usefulness for pigs	Usefulness for cattle & horses
TOTAL DISSOLVED SOLIDS	1500	Very good	Very good	Very good
This is a measure of inorganic ions, the most important criterion for evaluating water quality	1500-3000	Satisfactory except for poults under 3 weeks old	Good	Good
	3000-4000*	Satisfactory except for birds under 3 wk. old	Fair	Fair
		Wet droppings		
	4000-5000	Satisfactory except for birds under 4 wk. old	Usable No effect on productivity	Usable
		Wet droppings	Transitory diarrhoea on introduction	
	5000-7000	Unsatisfactory Wet droppings	May be unsatisfactory	May be unsatisfactory
		Erratic water intake	Causes diarrhoea	Causes diarrhoea, especially in lactating cows
		Reduced productivity	Reduced water intake	
		Health hazard	Health hazard	
	7000-10000	Unsatisfactory	Unsatisfactory	Unsatisfactory
	10000 +	Toxic	Toxic	Toxic

* Under experimental conditions animals have produced satisfactorily at this and higher levels of TDS. However, production and health problems have been noted in the field at levels of TDS below 4000 ppm. eg. During hot, dry weather polioencephalomalacia has been diagnosed in range cattle drinking from dugouts and ponds in Southern Alberta.

Item analysed	Water content (ppm)	Usefulness for poultry	Usefulness for pigs	Usefulness for cattle & horses
IGNITION LOSS Measures organic matter, temporary hardness and some carbonates	All levels	No problem	No problem	No problem
	If water is discolored with a rotten or brackish taste, check for bacterial contamination that may be a health hazard			
HARDNESS	<100 (Soft)	No problem	No problem	No problem
Ca and Mg HCO_3^-, $SO_4^{=}$, Cl^- Measured as $CaCO_3$	100-2000 (Hard)	No problem	No problem	No problem
SULPHATE	<500	No problem	No problem	No problem
Measured as $SO_4^{=}$	500-3300	Laxative	Laxative	Laxative
*Part of epsom salt ($MgSO_4$) and glauber salt(Na_2SO_4)	**(Additive effect with chlorides)	Increased water intake	Increased water intake	No effect on productivity
		Wet droppings	No effect on productivity	
		Health hazard to young birds		
	3300-5000	Unsuitable	Unsuitable	Scours
		Diarrhoea	Diarrhoea	Unsuitable for lactating dairy cows
		Health hazard	Reduced performance	
			Health hazard	Reduced voluntary intake of salt and mineral
CHLORIDE	<500	No problem	No problem	No problem
Measured as Cl^-	500-5000	Wet droppings	Looseness	No problem
	(Additive with sulphates but not as laxitive, see sulphate)	Reduced feed intake	Reduced feed intake	
		Increased water intake	Increased water intake	

* These salts are both purgatives, glauber salt being more so than epsom salt. Therefore sodium content can be an indication of the extent of the laxative effect to be expected. High sulphate levels (500 ppm) may interfere with copper absorption to produce copper deficiency in animals fed diets marginal in copper.

** Sulphates have about twice the laxative effect of chlorides therefore these two should be added together when water quality is being evaluated.

Item analysed	Water content (ppm)	Usefulness for poultry	Usefulness for pigs	Usefulness for cattle & horses
ALKALINITY	<500 pH < 8	No problem	No problem	No problem
Measured as $CaCO_3$	500-1000 pH 8-8.5	Satisfactory	Satisfactory	Satisfactory
	1000-2500 pH 9-10	May be unsuitable for young poultry at higher level	May be unsuitable for young pigs at higher level	May be unsuitable for young calves and lactating cows at higher level
	>2500 pH > 10	Unsuitable	Unsuitable	Unsuitable
pH	<8.5	No problem	No problem	No problem
	8.5-10	Tolerable	Tolerable	Tolerable
	>10	Unsuitable	Unsuitable	Unsuitable
SODIUM	<300	No problem	No problem	No problem
	>300 (Additive with potassium)	Satisfactory depending on alkalinity and pH.	Satisfactory depending on alkalinity and pH.	Satisfactory depending on alkalinity and pH.
	Both sodium and potassium contribute to alkalinity and therefore should be added together when water quality is being evaluated			
POTASSIUM	<300	No problem	No problem	No problem
	>300 (Additive with sodium)	Satisfactory, depending on alkalinity and pH.	Satisfactory, depending on alkalinity and pH.	Satisfactory depending on alkalinity and pH.
	Both sodium and potassium contribute to alkalinity and therefore should be added together when water quality is being evaluated			
CALCIUM	All levels	No problem	No problem	No problem
MAGNESIUM	All levels	No problem	No problem	No problem

Item analysed	Water content (ppm)	Usefulness for poultry	Usefulness for pigs	Usefulness for cattle & horses
NITRITES	Trace	Satisfactory	Satisfactory	Satisfactory
	>Trace (Indicates fecal contamination)	Health hazard	Health hazard	Health hazard
NITRATES	<100	No problem	No problem	No problem
*Measured as N	100-300	Satisfactory	Satisfactory	Health hazard with feed containing high nitrates
	>300	Unsuitable	Unsuitable	Nitrate poisoning when fed with feed containing high nitrates.
	* When measured as NO_3 divide by 4.43 to obtain ppm N			
	* When measured as $NaNO_3$ divide by 6.07 to obtain ppm N			
	* When measured as KNO_3 divide by 6.75 to obtain ppm N			
IRON	<0.3	No problem	No problem	No problem
	>0.3 (May encourage growth of iron bacteria which plugs water systems)	Tastes bad Minimal effect on water intake or productivity	Tastes bad Minimal effect on water intake or productivity	Tastes bad Minimal effect on water intake or productivity
FLUORIDE	<4	No problem	No problem	No problem
	>4	No problem	Browning and weakening of teeth	Browning and weakening of teeth.
	>40	Soft bones	Osteomalacia	Osteomalacia
CONDUCTIVITY	All levels	No consequence	No consequence	No consequence

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